# MAGNETIC STUDIES OF AVANHANDAVA H4 AND BJURBÖLE L4 CHONDRULES.

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**Introduction:** The Avanhandava (H4) and Bjurböle (L4) chondrites represent primitive chondritic material of low metamorphic degree. Their friable nature allows us to pick up oriented individual chondrules and to study their magnetic properties and magnetic mineralogy.

**Chondrule magnetic conglomerate test:** The chondrule magnetic conglomerate test was done on both meteorites by removing oriented chondrules from the meteorite matrix and comparing the direction of their NRM with respect to each other and to the matrix. The direction of the NRM (Natural Remanent Magnetization) of the chondrules seems to be randomly oriented within the meteorite. In contrast the neighboring matrix fragments show consistent directions of the NRM vectors. This characteristic is consistent to both of the meteorites.

**Magnetic properties of Avanhandava chondrules:** The chondrules carry a weak NRM in order of $10^{-2} – 10^{-1}$ $mAm^2/kg$, low coercivities (< 10 mT) and a low $J_{sr}$ to $J_s$ (saturation remanent magnetization to saturation magnetization) ratio ($\sim 10^{-2}$). During the AF (Alternating Field) demagnetization both the NRM and the $J_{sr}$ of the chondrules is stable up to 10 mT alternating field.

**Magnetic properties of Bjurböle chondrules:** The chondrules of Bjurböle meteorite can be classified into two groups according to their NRM. First group is characterized by absence of measurable NRM. The chondrules from the second group carry hard NRM (Natural Remanent Magnetization) and show high coercivities (~ 120 mT). During AF demagnetization the NRM of some Bjurböle chondrules is stable up to AF fields exceeding 100 mT.

**Magnetomineralogy investigations:** To study the magnetomineralogy of these meteorites the magnetic hysteresis measurements were performed in temperature range from 30°C to 820°C. In the case of Avanhandava H4 meteorite the kamacite (disordered $\alpha$-FeNi) was identified as the magnetic carrier. With respect to the high stability of both the NRM and the $J_{sr}$ during AF demagnetization (up to 10 mT) the grain size is estimated to be in SD (Single Domain) or PSD (Pseudo-Single Domain) range and thus suitable for paleofield investigations.

In the case of Bjurböle L4 meteorite the tetrataenite (ordered FeNi) was identified as magnetic carrier. This is supported by high coercivity and observed disordering do kamacite at temperatures around 500°C. There was no measurable anisotropy of $J_s$ at field 1.8 T observed in Bjurböle chondrules. Tetrataenite is magnetically the most stable form of FeNi and thus suitable for paleofield investigations.

**Paleofield estimate:** Prior the paleofield estimation the low-filed low-temperature magnetic contamination test was performed on the chondrules and significant fraction of uncontaminated chondrules was selected for further investigations. The paleofield method based on the REM ratio ($NRM/J_{sr}$) [1] reveals approximate paleofields between 5 μT and 20 μT (REM ~ 0.002) for Avanhandava chondrules and between 12 μT and 45 μT (REM ~ 0.0015–0.0048) for Bjurböle chondrules.

**Conclusions:** The chondrules of both Avanhandava and Bjurböle meteorites show a low and randomly oriented NRM. The paleofields determined on chondrules are lower than geomagnetic field. That suggests together with random NRM directions and results of low-field contamination test that chondrules are not magnetically contaminated by geomagnetic or artificial fields.

References: [1] Kletetschka G. et al. (2003) *Meteoritics & Planetary Science, 38,* 399-405.